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Subject : IRRigation engineering

Assignment : Final Term Paper.

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Q1:

a) Define Delta & Duty of a crop & write the significance of duty of crop.

Ans **Delta:** A crop needs a certain amount of water at fixed interval through out its base period. Depth of each watering 5cm - 10 cm.

The depth of water in cm or inches required for the crop through out the base period is called Delta of crop.

Duty: The duty of water is the relationship between the volume of water & the area of crop it matures.

Significance of Duty:

It helps in designing efficient canal irrigation system. Knowing that the total available water at the head of the main canal & the overall duty for

all the crops required to be irrigated in different seasons of the year, the area which can be irrigated can be worked out.

- Inversely if we know the crop area required to be irrigated & their duties, we can work out the discharge required for designing the canal.

b) Wheat requires about 10 cm of water after every 35 days & the base period or crop period of wheat is 140 days. Find out the Delta for wheat.

Given Data:

$B = 35$ days, $D = 10$ cm.

Formula:

$$\Delta = \frac{8.64\,B}{D}$$

Sol:

$$\Delta = \frac{8.64 \times 35}{10}$$

$$\Delta = 30.24 \text{ cm.}$$

Q) Explain the factors affecting consumptive use.

Ans) Consumptive Use or Evapotranspiration:

Def.

Consumptive use for a particular crop may be defined as the total amount of water used by the plant in transpiration & evaporation from adjacent soil or leaves.

Factors affecting Consumptive use:

- Temperature
- Humidity in air.
- Velocity of Wind.
- Soil Topography.
- Sunlight etc.

Q.No.2 (A) What are the principle causes and ill effects of water logging?

ANS:- (1) INTENSIVE IRRIGATION:- If Max. area of land is irrigated, percolation of water takes place. This causes the rise of water table.

EXTENSIVE IRRIGATION:- (irrigation spread over wider region) (to be followed to avoid water logging.

(2) SEEPAGE:- Seepage of water from adjoining high lands.

(3) seepage through Canal reservoirs:

(4) IMPERVIOUS obstruction:- Water seeping below the soil moves horizontally. It may find obstruction & water table may rise.

(5) INADEQUATE surface Drainage:- storm water & excess of irrigation water should be removed.

If proper drainage is not provided water percolates to rise water table.

(6) EXCESSIVE RAINS :- - Causes Temporary water logging.
- No drainage causes permanent.

(7) SUBMERGENCE DUE TO FLOODS :- Continued floods Calles the growth of water-loving plants which obstruct natural surface drainage & increases the water logging.

(8) Irregular And Flat Topography :-

In depressions the drainage is poor, water detention is more, the percolation increases the water table.

(b) DEScribe the anti-Water logging Measures.

ANS:- It Means how can we control Water logging. There are the following steps by which we reduces water logging.

(1) LINING OF Canals & WATER Courses:- ★

It reduces seepage of water. ★

(2) REDUCING INTENSITY OF IRRIGATION:-

★ only small portion of land should receive canal water in one particular season.

★ Remaining areas can receive water in next season by rotation.

(3) BY INTRODUCING CROP Rotation:- High water requiring crop should be followed by one requiring less water and then by one requiring almost no water.

Example: Rice followed by wheat and then by cotton.

(4) OPTIMUM USE OF WATER:- Certain amount of water gives the best result. Less or more water reduce the yield. cultivators should be educated so that not to use more water.

(5) Improving Natural Drainage of Area:-

* water should not be allowed to stay in one area.
* Natural flow is provided by bush and jungle cutting.

(6) PUMPING OR TUBEWELLS OR VERTICAL DRAINAGE:-

Lift irrigation should be introduced to use GW. Canal irrigation may be substituted by tube well irrigation.

(7) Economical USE OF WATER:-

Economical use of water according to need.

(8) ADOPTION OF SPRINKLER METHOD OF IRRIGATION:-

* only predetermined amount of water is supplied to land.
* No percolation losses from water courses.

(C) METHODS ADOPTED TO RECLAIM SALINE SOIL:-

* By maintaining the water table sufficiently below the roots.
* Hence all the measures which were suggested for preventing water logging hold good for preventing salinity of lands.
* An efficient drainage (surface & subsurface) must be provided to lower the water table in saline soils.

There are following Methods

(1) LEACHING:- In this process.

(i) land is flooded with water.
(ii) Alkaline salts will be dissolved in water.
(iii) percolation to the ground water.
(iv) Drained by sub-surface drains.

(2) SURFACE DRAINAGE:- Removal of excess of water using open ditches, field drains, land grading etc.

(3) LAND Grading :- It is a continuous land slope towards field drains.
- It is necessary for surface irrigation.

(4) SUBFACE INLET :- *A surface inlet is a structure constructed to carry the pit water into subsurface drain.

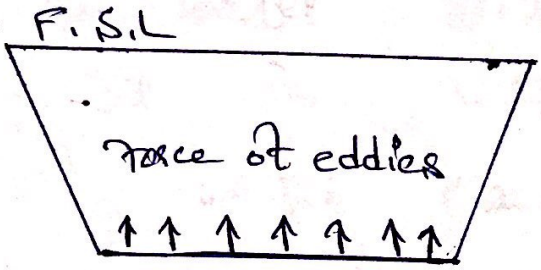
* The surface water from pot hole depressions, road ditches may be removed by
(i) Random field drain.
(ii) Inlet surface inlet.

Q NO.3 (A) DIFFERENCE b/w KENNEDY'S & LACEY'S THORIES:-

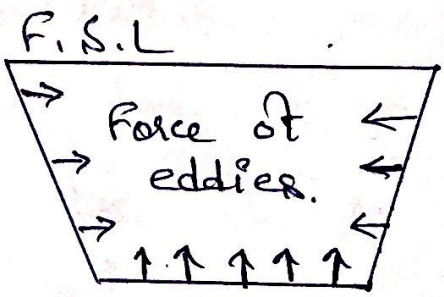
Comparison of Kennedy's & Laceys theory.

1) Both (K & L) considered that the vertical eddies are responsible for holding silt in suspension. But Kennedy neglected the eddies generated by sides.

Lacey considered the sides (so he included R instead of D).



According to Kennedy



According to Lacey.

2) Kennedy: All channels which are not silting or scouring are in regime. But Lacey differentiated between initial & final regime.

3) Lacey: Grain size is important.
Silt factor $F = 1.76 \times M^{0.5}$.

Q No.3 (b) Design a regime channel for a discharge of 30 cumecs and mean diameter of the particle of 0.56 mm by using Lacey's theory.

Solution:-

(1) Calculate the velocity from equation.

$$V = \left[\frac{Q f^2}{140}\right]^{1/6} \text{ m/sec.} \longrightarrow \text{eq (1)}$$

[where Q : discharge = 30 cumecs.
f : silt factor $\Rightarrow f = 1.76\sqrt{d_{(mm)}}$]

$$f = 1.76 \times 0.56$$

$$\boxed{f = 0.9856}$$

Put value of "f" & "Q" in eq (i)

$$V = \left[\frac{30 \times (0.9856)^2}{140}\right]^{1/6}$$

$$V = (0.209)^{1/6} \text{ m/sec}$$

$$\boxed{V = 0.92 \text{ m/sec}}$$

(2) Work out the hydraulic mean depth (R) from eq (3).

$$R = 5/3 \left[\frac{v^3}{f}\right] \rightarrow eq(3).$$

$$R = 5/3 \left[\frac{(0.09)^3}{0.9856}\right].$$

$$\boxed{R = 1.67mm}$$

(3) Compute wetted perimeter, P

$$P = 4.75\sqrt{Q}.$$

$$P = 4.75\sqrt{30}$$

$$\boxed{P = 26.} \quad \therefore$$

(4) compute area of channel section, A

$$A = Q/V = \frac{30}{0.09}.$$

$$\boxed{A = 15}$$

(5) And finally find the bed slope, S = ?

$$S = \left[\frac{f^{5/3}}{3340 \times Q^{1/6}}\right] \cdot \left[\frac{(0.9856)^{5/3}}{3340 \times (30)^{1/6}}\right].$$

$$\boxed{S = 16.6m.}$$

Q4: Write notes on the following.

Ans: Permanent Wilting Point:

A plant can extract water from soil till a permanent wilting is reached. PWP is that water content at which a plant can no longer extract sufficient water for its growth & wilts up.

Field Capacity:

When all gravity water has drained down to water table a certain amount of water is retained by surface soil. This water cannot be easily drained under the action of gravity is called Field Capacity.

Canal Head Regulator:

A structure which is constructed at the head of the canal to regulate flow of water is known as Canal Head Regulator. It consists of number of

piers which divide the total width of the canal into a number of spans which are known as bays, the piers consists of number of tiers on which the adjustable gates are placed.

Under Sluices:

Also known as scouring sluices. The under sluices are the openings provided at the base of the weir or barrage. These openings are provided with adjustable gates. Normally the gates are kept closed. The suspended silt goes on depositing in front of the Canal Head Regulator.